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THE ATOM

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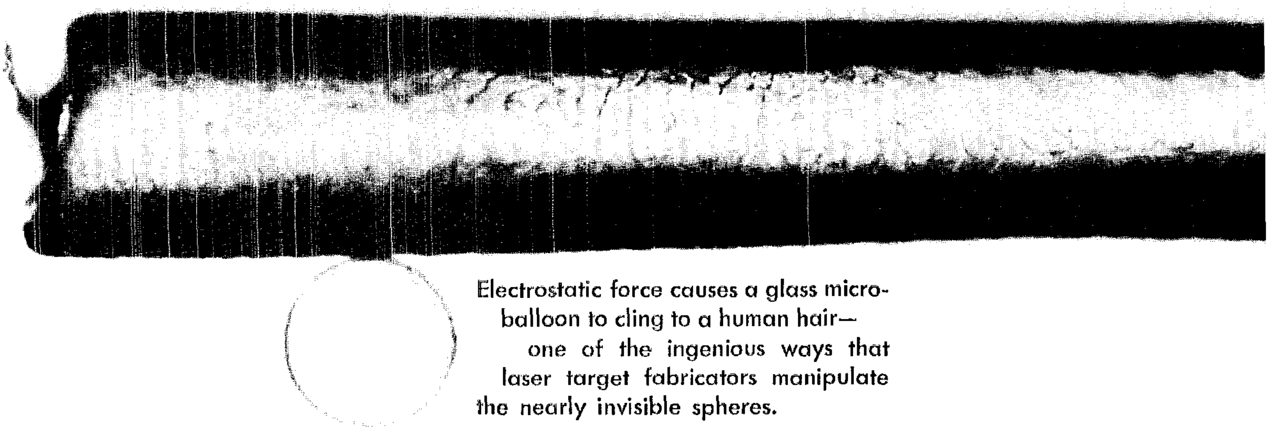
COVER

The "guys in the Shop"—the Glass Shop, to be specific—use the means at hand to form a Christmas-tree ornament and, in so doing, extend a photographic greeting to the rest of the Los Alamos Scientific Laboratory on behalf of the Shop Department.

Originally staged at the request of ISD-1 photographer Bill Jack Rodgers, the "guys" rather like the product of their handiwork and plan to place it atop the Shop Department's Christmas tree.

Forming the ornament is Lou Schlatterer. The flame is not really hitting and curling around his hand; the camera angle just makes it look that way. Watching, left to right, are Bill Fox, Eulogio Serrano, and Max Newman.

For more on the Shop Department and the ultra-precision work it is now performing with some rather sophisticated equipment, see the story beginning on page 12.



Electrostatic force causes a glass microballoon to cling to a human hair—one of the ingenious ways that laser target fabricators manipulate the nearly invisible spheres.

A Pellet in a Million

Finding that 1 perfect microballoon in a million, filling it with gas through a wall that has no opening, and mounting the speck on a gossamer film of plastic to make a laser-fusion target is the strange business of the laser target fabrication section of Group L-4 (laser experiments and diagnostics).

To conduct this business, a new technology in a nether world between the barely visible and the not quite visible has been created. The physics involved ranges from the very ancient to the ultramodern, and the equipment varies from simple eyedroppers and camel hairs to LASL's Van de Graaff accelerator.

So minuscule are the glass spheres that a quart jar holds 2.5 billion of them. En masse, the microballoons resemble powdered sugar, but are eerily viscous in their behavior. When the jar is rocked, waves and cascades form in slow motion, gradually subsiding after the jar is stilled.

So light are they—a gallon weighs but a pound—that a spill may result in a myriad of microballoons becoming suspended like dust in the air. Weeks later, one may settle alongside a perfect specimen to bedevil researchers. Gravity becomes useless for certain screening processes and "anti-gravity" must be used.

Working with such nebulous stuff would drive many men right up the walls. But the 3 men in L-4's target fabrication section who actually handle the microballoons seem to positively revel in the work. "It's work that has no precedents and it's full of surprises. We have to devise our own systems and tools as we go along. It certainly stimulates ingenuity, and there's a lot of excitement in devising ways to get the job done," Jay Fries, the section leader, says.

Now It Can Be Told

A year and a half ago, the laser target fabrication section of L-4 did not exist. It was formed when the development and progressive power increases of L-Division's neodymium glass and CO_2 lasers made it obvious that suitable pellets containing the hydrogen isotopes deuterium and tritium (DT) would soon be needed as targets in laser-fusion experiments.

Powerful as LASL's lasers are, they do not yet deliver power sufficient for any but the smallest targets. Their beams must be focused to an extremely fine point to achieve the power density that theory predicts is necessary to initiate a thermonuclear reaction. Hence the requirement for the tiny pellet.

The behind-the-scenes story of how the pellets are prepared and

"A good binocular microscope and extreme patience are vital for handling these things," says Jay Fries, L-4. The probe of the *microvacuum pickup under the microscope* at the left is enlarged, above right. A pellet clings to its tip, but is invisible to the camera.

Removing microballoons from fluid en masse is accomplished by skimming an eyedropper around the meniscus, where spheres collect. Spheres float up into the eyedropper.

tested is an example of innovation, teamwork—and a lot of hard work.

Finding Needles in Haystacks

Microballoons in 10-gallon containers produced by commercial suppliers arrive at LASL as the raw material—with the emphasis on the "raw." They are a motley lot indeed because of the process by which they are formed.

Tiny particles of glass, blended with a blowing agent such as urea, are dropped down a heated tower. The blowing agent gasifies and expands the molten glass into its spherical shape.

That's what it's supposed to do, anyhow. In practice, spheres and other shapes of varying sizes and with varying imperfections are formed. Fries estimates that the spheres with perfect size, shape, and uniform wall thickness exist in the ratio of about 1 in a million. Finding that 1 requires an elaborate process of elimination.

The first step is to screen the microballoons by size. However, gravity can't pull the ethereal glass puffs down through a screen. So, "anti-gravity" is used.

A quantity of spheres is placed in ethanol, above which are placed screens of increasing fineness in an inverted screening process developed by Gene Farnum, L-4. Buoyancy, assisted by ultrasonic agitation, forces the balls upward through the screens until a small quantity of survivors of the desired size collect at the top. As a by-product, spheres with cracks or gross porosity fill with fluid and do not join the upward procession.

To further separate cracked or over-porous spheres, a liquid sink/float process is employed. A liquid containing the spheres is subjected to pressures alternating between a near vacuum and normal atmospheric. This results in pumping liquid through the walls of defective spheres, which sinks them, while the "good" spheres remain suspended in the liquid.

The spheres are then separated according to average wall thickness, a function of density. They are placed in sulfur hexafluoride gas: the application of pressure—typically from 300 to 600 psi—varies the density of the gas. Microballoons of equal density remain suspended; those of greater or less density sink or float. Some work on size and density separation is also performed by Bob Riley and John Magnuson of Group CMB-6.

However, these processes do not determine uniformity. Because a sphere of uniform wall thickness offers maximum resistance to implosive force, spheres are placed in a vessel and subjected up to 1,700 atmospheres of pressure. As the pressure mounts, nonuniform spheres collapse. Sensitive sonic transducers pick up the sounds of these tiny implosions—amplified, they sound like corn popping.

Jay Fries, laser target fabrication section leader, inspects a mount, above left. A transparent film spans the hole in the mount, and a microballoon is mounted at the center of the hole. After mounting, the target receives an additional plastic coating for absorptive and ablative effects in a vapor deposition device as Gene Farnum, L-4, above center, demonstrates.

Emergency! Work halts as Fries and Farnum man a vacuum cleaner to pick up the spilled spheres before they become airborne to disrupt processing.

During the foregoing processes, transfer and handling of the spheres from one container to another is accomplished by several ingenious means.

To collect the spheres floating in a liquid, technicians enlist the help of the meniscus—that curved portion of the liquid's surface that forms against the container's walls. As this is the highest point available to the spheres, they float up into it. An eyedropper filled with the same liquid as in the container may be used to skim the meniscus. The spheres float up into the eyedropper.

Or, to remove them one by one, a human hair, or better, a camel hair, which is naturally tapered, is used. Good lighting and the fortuitous lens effect of the meniscus enables a sharp-eyed technician to spot the microballoons. Then, by touching a hair to the ball, the ball will float upwards in the liquid coating the hair. It may then be gently "brushed" up the side of the container.

To remove the ball, a force discovered by Thales of Greece in 600 B.C. is utilized—static electricity. Wiping the hair across fabric (ordinary clothing will do) gives it a slight electrostatic charge. Touching the hair to the ball on the beaker wall will cause the ball to cling to it, making removal possible.

For mounting and other operations, a microvacuum pickup is used, modified to incorporate a compressed-air blowback system. Vacuum sucks the microballoon to the tip of a probe; electrostatic force holds it there even with the cessation of the vacuum, and a gentle blowback "shoots" the sphere to its target.

At other times, binocular microscopes in combination with either a camel hair or the microvacuum pickup is used. Fries remarks, "A good binocular microscope and extreme patience are vital for handling these things."

Doing much of this fussy work is Amo Sanchez, possibly the world's first laser-fusion target fabrication technician, certainly the first at LASL. With mounting and handling time estimated at 1½ hours per microballoon, it appears that Sanchez will have plenty to keep him busy.

Fill 'er Up

Spheres are sent to group M-1 (nondestructive testing) where, with much of the same equipment and techniques, spheres are mounted in an array of 100, arranged 10 x 10. A camel hair or a microvacuum system is used to place the spheres onto a thin plastic sheet coated with oil. The microballoons adhere with remarkable tenacity; surface tension holds them firmly in place, even allowing them to be handled normally in interoffice mail.

Max Winkler and Ron London, both M-1, then perform x-ray radiography to spot flaws and to measure each sphere, recording characteristics on a matrix which is returned to the L-4 laser target fabrication section. Upon receiving the spheres, the target fabricators choose suitable targets, pick them up with the microvacuum system, and blow them into acetone to cleanse them of oil. They are then retrieved and sent to Don Coffin, Bob Stoll, Al Manthei, and Lorene Sturgess at group WX-5 with the request to "fill 'em up."

In everyday life, glass is considered—and for practical purposes, is—impermeable. But in very thin sections, such as in the microballoons, it is permeable. Thus, by placing the spheres in a pressure vessel, introducing a suitable DT gas mix, heating the container and applying pressure, the gas can be literally driven through the spheres' glass walls.

Cooling the spheres reduces their permeability. With certain types of glass of uniform wall thickness, the microballoons will contain the gas —initially at 100 atmospheres pressure—for considerable time at room temperature. Samples currently being used have a half-life of about 1 year, i.e., at the end of a year, half of their gas will have "leaked" away.

Putting It Together

To spare laser-fusion experimenters the impossible task of handling targets the size of dust, and to facilitate the implosion process, the target microballoons must be mounted.

A drop of cellulose acetate solution is allowed to fall on water; spreading, it forms a very thin film. After the solvent evaporates, a molybdenum strip with a small hole at one end is maneuvered in the water under the film. When lifted, the plastic clings to it, including a portion spanning the hole.

A second layer of plastic, this time of polystyrene, is formed on a glass slide, floated off onto a water surface, then picked up by the acetate-coated mount in a manner similar to the original plastic coating technique.

To mount the microballoon, it is placed in a position on the duplex film. Careful application of heat partially melts the polystyrene film without melting the acetate base. The cooling polystyrene bonds the target sphere firmly in position.

For many experiments, a final process is required. In a process developed by Gary Simonsic, CMB-6 (materials technology), the mounted target is placed in a vapor deposition furnace with the target facing downward toward a crucible below. Vaporized polyethylene ascends, coating the facing hemisphere of the microballoon. It also is deposited on the area behind the sphere forming a disk, except for the "hole" caused by the sphere's "shadow."

This results in a shape that produces an absorbing and ablating effect, briefly surrounding the target with a mantle of high-energy plasma, upon the impact of the laser beam, and thus facilitating the implosion mechanism that may trigger fusion. It allows experiments to be conducted with a single laser beam. Without it, multiple beams would have to be used to achieve a uniform effect.

Experimenters in L-Division using the targets haven't achieved clear-cut fusion—yet. Results have been encouraging, however. Ultimately, a large part of the tiny pellet's energy may be released, pointing the way to practical laser-fusion power generation.

Checking Things Out

From time to time, the laser-target fabricators need to determine just what is inside the glass spheres: how much tritium, how much deuterium. For fast checks, a sphere may be placed in an extremely sensitive x-ray counter devised by Group L-4. If tritium is present, its radiated electrons will interact with atoms in the glass, causing the emission of x rays. Counting the x rays gives a measurement of tritium in the sphere and, with the ratio of tritium to deuterium known, an indication of deuterium present, too. These measurements also indicate pressure. "Used in this manner, a gas-filled microballoon may be the world's smallest x-ray tube," Farnum comments.

For more extensive measurements, and to obtain calibration for its own instruments, L-4 occasionally takes a gas-filled microballoon to LASL's Van de Graaff accelerator, operated by group P-9, for analysis using a method developed by Bill Jarmie, P-DOR. "I feel a little silly every time I go over there, thinking of all that huge equipment being used just to take measurements of a little speck It's like using a 16-inch artillery piece to shoot minnows in a bucket," Fries says.

But the "heavy artillery" is vital. A proton beam interacts with the DT gas; counting emissions at particular angles yields extremely accurate measurements of hydrogen isotopes present.

In addition to glass spheres, the laser target fabrication section has been experimenting with microballoons of other materials made for them by Group CMB-6: glass microballoons coated with various materials as well as microballoons of pure metal. Some of the latter will withstand pressures equivalent to those encountered at ocean depths of 7 miles.

Additional methods of handling and separating the spheres will surely be devised. "For instance," says Farnum, "we think there's a real potential in coating the perfect spheres with honey. That's right, good old-fashioned honey. Then, we'll use ants. They'll pick up the honey-coated balls and take them to their nest, leaving the uncoated spheres behind. All we'll have to do is raid their nest and we've got our spheres. Think of the labor savings, the cost-effectiveness of it all!"

A roar of laughter from Fries unmasked Farnum's statement as a put-on.

And yet, if you should visit L-4's target fabrication laboratory at Ten Site and see a bunch of ants scurrying about, some with tiny glistening specks clutched tightly in their mandibles, don't step on them.

"No general would have lost any battle if he had had back-up and cooperation like we had that night," said Morton Kligerman, Los Alamos Scientific Laboratory assistant director for radiation therapy.

And, as if to remove any doubt as to what he meant, he added, "I have never seen a team like this—and I have been on a helluva lot of teams."

Kligerman was reliving the suspense, the exhausting work, and the final triumph of that historic night, Monday, October 21st, when, for the first time, human cancer patients were exposed to pion radiation at the Clinton P. Anderson Los Alamos Meson Physics Facility (LAMPF).

Many biomedical researchers are hopeful that pion radiation will ultimately provide some significant advantages over conventional x-ray or cobalt radiotherapy. These would be attributable to the exotic nature of pions themselves.

At LAMPF, pions (or negative pi mesons) are formed by accelerated protons striking a suitable target. Emitted are pions, visualized as the "glue" that binds together the atomic nucleus. Their lifespans are measured in millionths of a second and are terminated when the particles disintegrate in star formations consisting of other particles, x rays, and gamma rays.

Pions may be directed into cancerous tissue before they explode. Thus, rather than the comparatively indiscriminate shotgun effect of conventional radiation, pions act more like artillery shells passing through the air with little disturbance to explode on their targets. The range of radiation from these star formations is extremely short, so that the radiation need not penetrate appreciably beyond the boundaries of the tumor.

Pion radiation holds the bright promise of ultimately giving radiotherapists a beam that may (1) be focused with greater precision than present x-ray or cobalt radiation on cancerous tissue while largely sparing intervening and surrounding healthy tissues, (2) provide equivalent dosage with less total energy

A Night to Remember

A long, tense night ends with an historic experiment successfully concluded. Traditionally, accelerator experimentalists celebrate milestone achievements with a ceremonial sip of champagne—and a great deal of congratulations and banter. Ed Knapp, LAMPF associate division leader for practical applications, and Morton Kligerman, assistant director for radiation therapy, are among those signing a souvenir bottle.

"... it may eventually place

a potent new weapon in the hands

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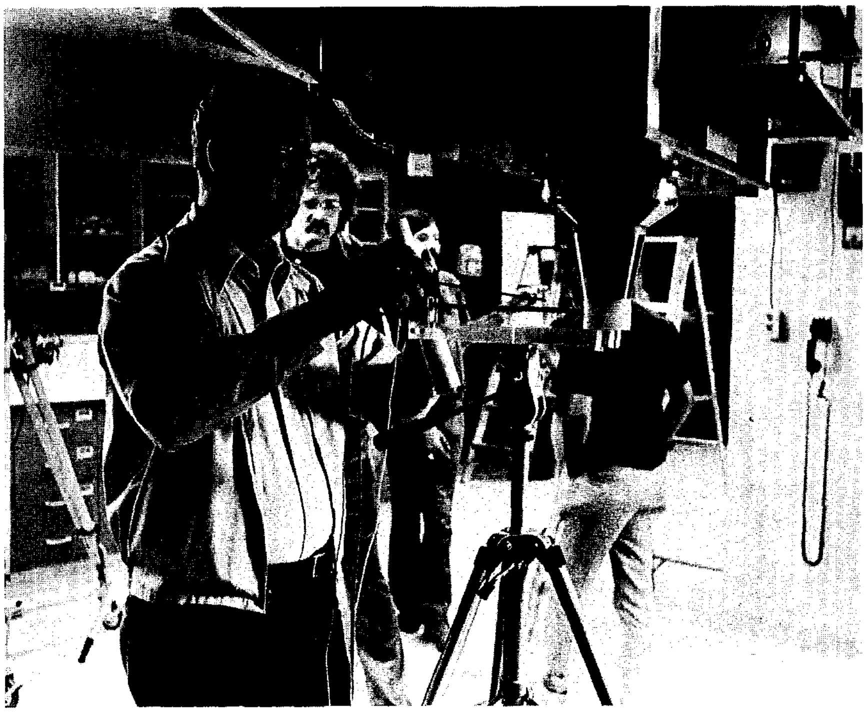
war against cancer."



With the aid of a tripod, Tom Lane, MP-3, positions dosimeters to measure radiation intensity at the tip of the pion cone.

absorbed, thereby reducing aftereffects, and (3) deliver cancerocidal doses to deep-seated tumors which are impossible to treat at present with conventional radiotherapy without unduly damaging critical, sensitive tissue.

But these benefits, if they materialize as hoped, remain for the future. At the present time, pion radiation is at a stage comparable to man's first venture across a stream in a log canoe. Much more must be learned before great voyages of discovery can begin.

The first application of a pion beam on human patients, therefore, had a very simple goal: an attempt to duplicate with a pion beam as closely as possible the known effects of an x-ray beam upon like tumors and normal tissues. Accomplishing this would give investigators today, and radiotherapists tomorrow, a reproducible "instrument" they could use with confidence.

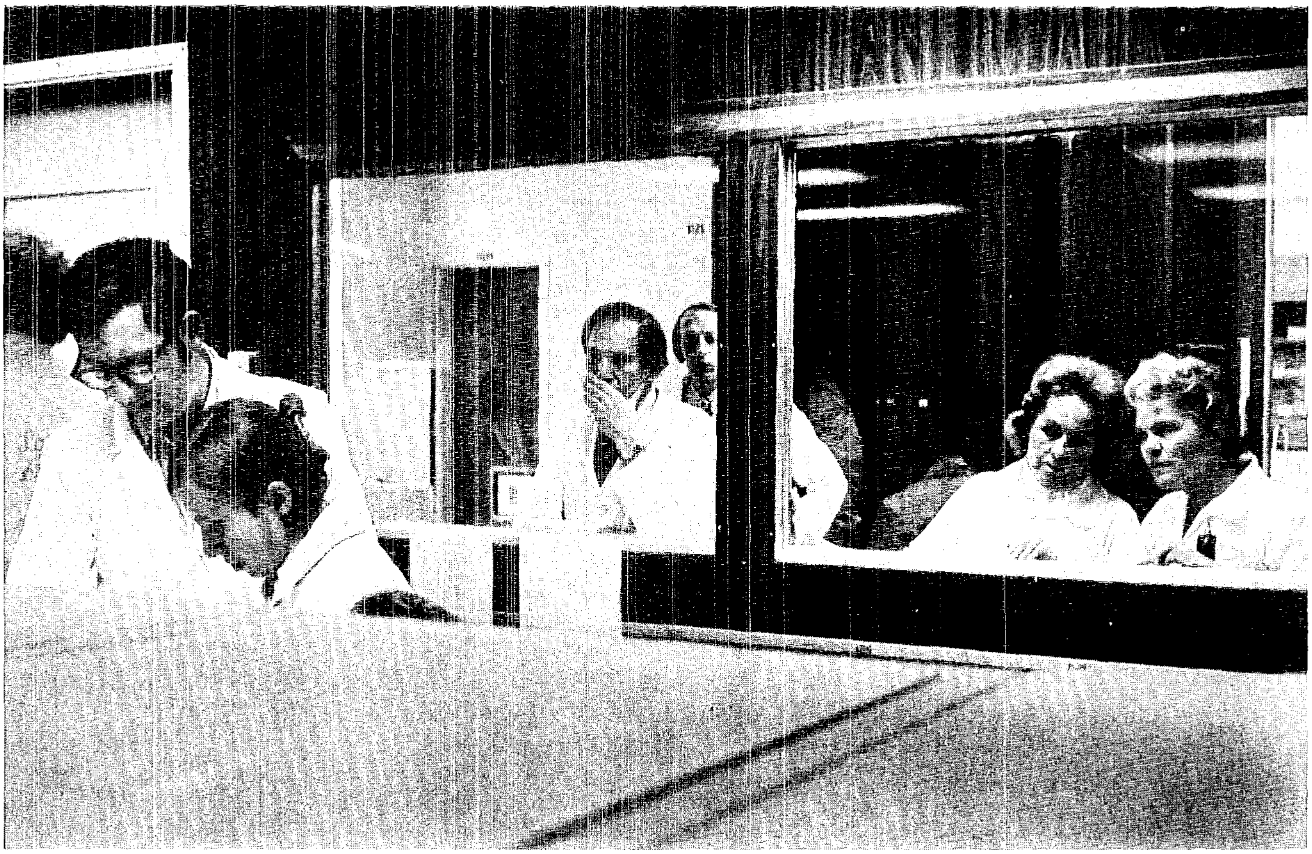
Achieving this simple goal was fraught with complexities—and with potential consequences that may be ignored when experimenting with tissue samples and animal targets, but not with human subjects. Of these, those causing the greatest concern were that the pion beam would affect healthy tissue to a degree greater than predicted, and that detrimental aftereffects, impossible to discern in animals, might manifest themselves in humans.

Hence the tension, the careful preparations, and the elaborate provisions for human comfort and safety for this seemingly simple experiment.

The Patients Arrive

Two female patients had arrived in Los Alamos 2 days prior to the scheduled experimentation date and were given attractive accommodations in apartments provided by the Los Alamos Medical Center. One woman was accompanied by her husband, one by her niece, and both by their physicians.

The 2 women had much in common. Both were older women and both had primary cancers, from



Tension mounts as Lane and Sally Shlaer, MP-1, monitor computer displays while Kligerman, UNM medical physicist Ed Barnes, and nurses Kitty Jones and Shirley Robbins watch.

which cells had lodged just under the skin to form nodules, or secondary tumors.

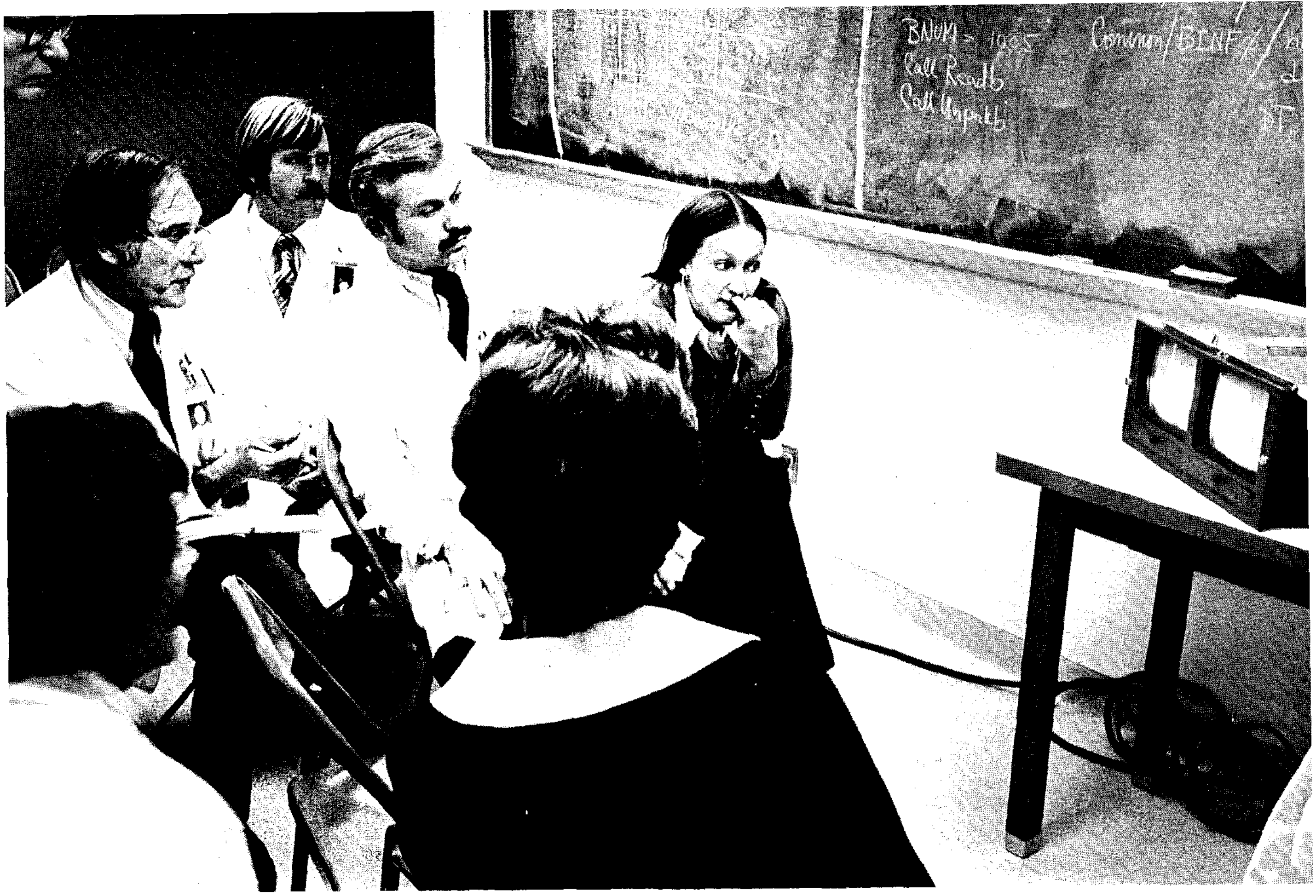
Both were volunteers and both fully understood that they had come to Los Alamos not for an attempted cure of their primary tumors, but to allow physicians and LASL researchers to learn the effects of pion radiation as compared to x-ray radiation upon their nodules.

"They were beautiful people," Kligerman comments, "vitally interested and involved, cooperative, and with a very positive outlook. By making our tests possible, they made a very real and meaningful contribution to medical research."

The 2 women had arrived at LAMPF as a result of a meticulous screening procedure set up by the University of New Mexico's Cancer Research and Treatment Center, which was responsible for the medical aspects of the test, and of which Kligerman is also the director. Essentially, recommendations for suitable patients are elicited from various hospitals, and a committee of physicians associated with the UNM Cancer Research and Treatment Center makes the final selections. Strict guidelines are followed to assure that patients selected are fully aware of the nature of the experiments and what can be expected or, more important, not expected from the radiation.

To provide maximum comfort and, if need be, medical care for the patients, close rapport has been established with the Los Alamos Medical Center. The Center set up an ambulatory care unit in the apartment building and is prepared to provide hospital or any other services required.

For 2 years prior to the patients' arrival, theoretical work had been conducted principally by Ed Knapp, LAMPF associate division leader for practical applications, Jerry Helland, Mike Paciotti, Dick Hutson, Jim Bradbury, all MP-3, and Chaim Richman, H-10. During the preceding 4 months, Paul Todd,



Pennsylvania State University professor of radiology, M. R. Raju, H-10, Don Petersen, H-9, Leo Gomez, H-4, Chuck Sternhagen, UNM Cancer Research and Treatment Center, and Kligerman ran a series of pion radiation experiments with tissue samples and animals while John Dicello, Tom Lane, and Howard Amols, all MP-3, made extensive physical measurements.

A near zero-hour report of contradictory results from tests on mouse tumors almost delayed the program. A conference was hurriedly called. The problem was resolved, and the program proceeded on schedule.

"Frequent conferences were a vital part of the program," Kligerman remarks. "They were exciting events. We were constantly teaching each other."

At 6:45 on the evening of October 21, the patients and their retinues arrived at the LAMPF Biomedical Research Facility. The preparation of the first patient culminated in the application of a flexicast, a device to hold the patient's target area rigid, yet with sufficient gentleness to minimize discomfort.

The Experiment

Now the drama begins. The first patient is wheeled beneath the pion cone. Watching via closed-circuit television are those whose work, for the moment, is completed, consulting physicians, and other observers, including Louis Rosen, LAMPF director, standing by unobtrusively to provide any assistance needed.

All is in readiness in the control room—Arvid Lundy, MP-3, Sally Shlaer, MP-1, and Frances Dobrowolski and Ed Barnes, both of the UNM Cancer Research and Treatment Center, having much earlier checked and double checked the systems as well as the computer that makes the control of the beam possible.

All is in readiness as far as the accelerator itself is concerned; Don Hagerman, associate division leader for accelerator operations, and group MP-2 having previously tuned the beam. During the long hours lying ahead, the beam was to operate with unvarying reliability.

Attending physicians and nurses position the patient, making final checks and adjustments, and then leave the treatment room. The patient is alone. Via an intercom, a registered nurse talks to the patient and the patient answers, assuring her that she is comfortable and ready.

The beam is turned on. For almost 30 minutes, an air of quiet tension prevails. But all goes like clockwork. The patient is removed from the exposure cell.

The patient is alert and vitally interested in the events of the night. She asks to view the procedure for the second patient on closed-circuit TV. As she watches, she seems to be rooting silently for her companion now in the room she herself so recently occupied.

On the opposite page, UNM Cancer Research and Treatment Center medical staff members and LASL personnel anxiously watch CCTV, viewing patient in treatment room on the screen at left, data from the experiment in progress on the right.

The expression on the face of Arvid Lundy, MP-3, upon hearing the good news at the end of the experiment, says it all.

As the final preparations for the second patient are being completed, the patient's husband leans over, kisses her, and gently jokes about the gadget on her tummy. The patient smiles. The husband, physicians, and nurses leave the room.

The beam is turned on—but this time things do not go like clockwork. The patient reports increasing discomfort. The physicians order the beam turned off, and a medical team re-enters the treatment room. Her position had caused pain, so another nodule, another position is selected. The medical team leaves, the beam is turned back on.

The new position is comfortable, the exposure proceeds smoothly. "Good girl," the first patient murmurs while watching the TV monitor.

Both patients are then transferred to another room where selected nodules receive conventional x-ray radiation.

The first patient, in good spirits, is brought back into the cell for her second pion exposure on another nodule. Again, the exposure is conducted smoothly.

The exposures are completed. Post-exposure examinations of the patients are made. Data from dosimeters and other instruments are collected. The report: The experiment had been successfully conducted.

Now at 1 a.m., comes the traditional bottle of champagne, the congratulations to the some 60 men and women who had been immediately involved in the experiment, the banter. A night to remember.

Looking Ahead

Where to now?

"For the immediate future, continued analyses of results," Kligerman says. "We have irradiated 11 nodules as of the end of November. During December, a longer series of tests will be carried out on a treatment schedule identical to that used for definitive treatment of primary tumors, though at reduced total doses."

"The LAMPF shutdown for scheduled maintenance, beginning on December 24, comes during a period compatible with our program. We need that time anyway to complete our analyses and watch for the appearance of delayed aftereffects, if any.

"We should be ready to resume experiments in July when LAMPF is back in operation. If all goes as expected, we should be ready for more advanced work, possibly later in the year, using pion radiotherapy to attempt remissions of primary tumors as compared to the preliminary type of experiments we are conducting now."

When and if that day comes, it may eventually place a potent new weapon in the hands of radiotherapists in their war against cancer.

And LAMPF will have realized one of its societal goals for which planning started more than a decade ago.

WASHINGTON BRIEFS

Goodbye AEC, Hello ERDA

On October 8, Congress passed the Energy Reorganization Act of 1974. On October 11, President Ford signed it into law, thereby abolishing the Atomic Energy Commission no later than 120 days (February 8, 1975) from the date of the law's enactment. President Ford is empowered to effect the change at an earlier date, should he choose, after appointing all of the top officials as required by the act.

The functions and most of the personnel of the AEC will be transferred to 2 new agencies: the Energy Research and Development Agency (ERDA) and the Nuclear Regulatory Commission (NRC). The 2 agencies will employ 92,000 government and contractor personnel and will have budgets totalling $4.2 billion.

ERDA, the agency of special interest to LASL because of its contractual relationship with the University of California, will be run by an administrator, a deputy administrator, and 6 assistant administrators for (1) fossil energy, (2) nuclear energy, (3) environment and safety, (4) conservation, (5) solar, geothermal, and advanced energy systems, and (6) national security.

President Ford has named former Air Force Secretary Robert C. Seamans to head ERDA and the President is expected to name the deputy and assistant administrators in the near future. (Note: AEC Chairman Dixy Lee Ray has been named an assistant secretary of state working with scientific problems of an international nature.) Heading NRC, with which LASL is expected to have frequent dealings in respect to nuclear safety, etc., will be former AEC Commissioner William Anders.

How will LASL be affected by the changeover? In a nutshell, according to Harold Agnew, Director, "Basically unaffected, initially. The future will depend on the Administrator and his deputy and assistant and the committee structure in the Congress. We will just have to wait and see what evolves."

The outlook:

University of California. LASL will continue to be operated by the University of California under a contract with ERDA.

Weapons. Present programs will continue for at least 1 year under ERDA. During this period, the Secretary of Defense and the Administrator of ERDA will consult and recommend to the President and the Congress whether or not various weapons programs be transferred to the Department of Defense or to other federal agencies following the one-year period.

Energy. Nuclear energy programs will be continued under ERDA with possibly enhanced status for nonnuclear and energy-related programs due to the new ERDA organization.

Security. Present policies, procedures, and personnel are expected to be unaffected except for the name change.

Other. Programs such as cancer research supported by entities other than the AEC should be unaffected.

For the short range, the effects of the changeover upon LASL will pose administrative problems, but are likely to be mostly superficial. For the long range, new personalities at policy-making levels, new inter-relationships of the new agencies with each other, within the Administration, and with the Congress will undoubtedly lead to eventual changes in emphasis and direction. Just what these changes may be, no one is in a position to hazard a guess at the present, but the future overall should be bright.

Planning Ahead

If during November you noticed your division or group leader poring over ledger sheets and punching his desk calculator somewhat frantically, you can attribute this to the new Budget and Impoundment Control Act signed into law by the President on July 12, 1974.

Your division or group leader was striving valiantly to complete not 1, but 3, DMA (Division of Military Application) budgets by a December 1 deadline. Not only did he have Fiscal Year 1976 (FY-76) with which to contend, he had to prepare a budget for FY-77 as well, plus a budget for a freak three-month fiscal "year," FY-76-A.

Small wonder your division or group leader may have seemed a bit distracted. Tell him to cheer up—next year will be better.

The Budget and Impoundment Control Act was passed as a measure to give both the Administration and the Congress more time to weigh budget requests and for Congress to pass an appropriation bill before the beginning of each fiscal year. At present, the legislative process, which evolved on a "grow like Topsy" basis, frequently has resulted in Congress being unable to pass an appropriations bill prior to its summer recess. "Continuing resolution" legislation then must be rushed through to keep various government agencies operative.

Two measures incorporated in the Act would appear to solve the problem. One is to require U.S. government agencies to submit budget projections 1 year earlier than has been the practice. The other is to change the calendar period of a fiscal year from July-June as at present to October-September.

The latter change creates a three-month period between July 1 and September 30 of 1976 which somehow must be accounted for. Hence, the creation of FY-76-A, not a year at all, but a one-time-only accounting and budgeting period to span the gap between the end of FY-76 on June 30, 1976, and the beginning of FY-77 on October 1, 1976.

Next year, things will be smoother. During the fall of 1975, division and group leaders will have but 1 fiscal year with which to contend, FY-78. While planning and budgeting for a period that begins 2 years in the future will pose some problems, there are compensations. The long-range aspects of budgeting and planning will be enhanced, with many benefits, and there will be fewer of the cliff-hanging uncertainties hovering over many funded programs as "zero hour" comes and goes with no one knowing whether a given program is to receive support that is increased or decreased—or whether it will continue to be supported at all.

On the national level, interactions between the Administration and the Congress are altered. In the future, impounding funds by the Administration may still defer the release of funds, but the Congress may vote to countermand such deferments.

The Office of Management and Budget will have more time to review individual agency proposals and to integrate these into an overall budget. New committees in both houses of the Congress will evaluate budget proposals on an overall basis related to revenues and make recommendations to other existing committees, presumably with ample time to perform these functions.

While new political processes rarely function with the perfection their authors expect, the consensus is that the Budget and Impoundment Control Act is a meaningful step forward. For LASL, the net result should be more efficient long-range planning and fewer uncertainties.

New Images in LASL's Shops

Stories in *The Atom* come about in many ways. Occasionally one comes along as a result of serendipity. It's as if you were to stumble across a small corner of something sticking up above the ground; it looks interesting but hardly monumental. Then you dig a bit and uncover a treasure chest.

Such was the case with the Shop Department recently. A phone call from Al Driesner, assistant department head and SD-2 (engineering) group leader, started it. He described a recently installed rotary contour gauge measuring complex curved surfaces to within millionths of an inch and which cost more than a quarter of a million dollars. This promised to be an interesting photo and caption, but not a great deal more. A visit to the Shop Department changed all that.

A walk through the sprawling facility revealed that changes have been taking place of which not even many Laboratory groups that deal with the Shop Department are fully aware. In a nutshell, the Shop Department has made substantial advances within the last year in its capability to form complex shapes with precision measured in the millionths of an inch on an almost routine basis. Environmentally controlled rooms, minicomputers, lasers, and a new metrology laboratory where weights and measures are kept to satisfy the Shop Department's own stringent requirements are some of the recent developments that have enabled the department to keep pace with science's demands for ever-increasing standards of precision.

Because of Los Alamos' isolation and for security reasons, shops have been an essential part of the Los Alamos Scientific Laboratory since the first days of the Manhattan Engineer District. In those days, each division requiring shop services had its own shop. In 1945, the present Shop Department was formed with the late Gus Schultz as its first department head. In 1954, the main shops building was completed. In 1959, Frank Stack, who had come to Los Alamos as a U.S. Army mechanical engineer, and also had been an apprentice machinist, was named Shop Department head.

Today, Stack heads an enterprise which in the "outside" world would be considered a substantial multi-million dollar business. "We are probably the largest research and development shop in the country," Stack says.

The Shop Department has more than 300 employees, 250 of whom are machinists. In addition to the main "plant" at SM-39 on Pajarito Road, which houses 13 shops, there are 32 branch shops, under the supervision of Ed Gritsko, SD-5 group leader, throughout the Laboratory where specialized quick turnaround work—such as machining the aluminum coils for CTR-Division's Scyllac—can be handled more expeditiously.

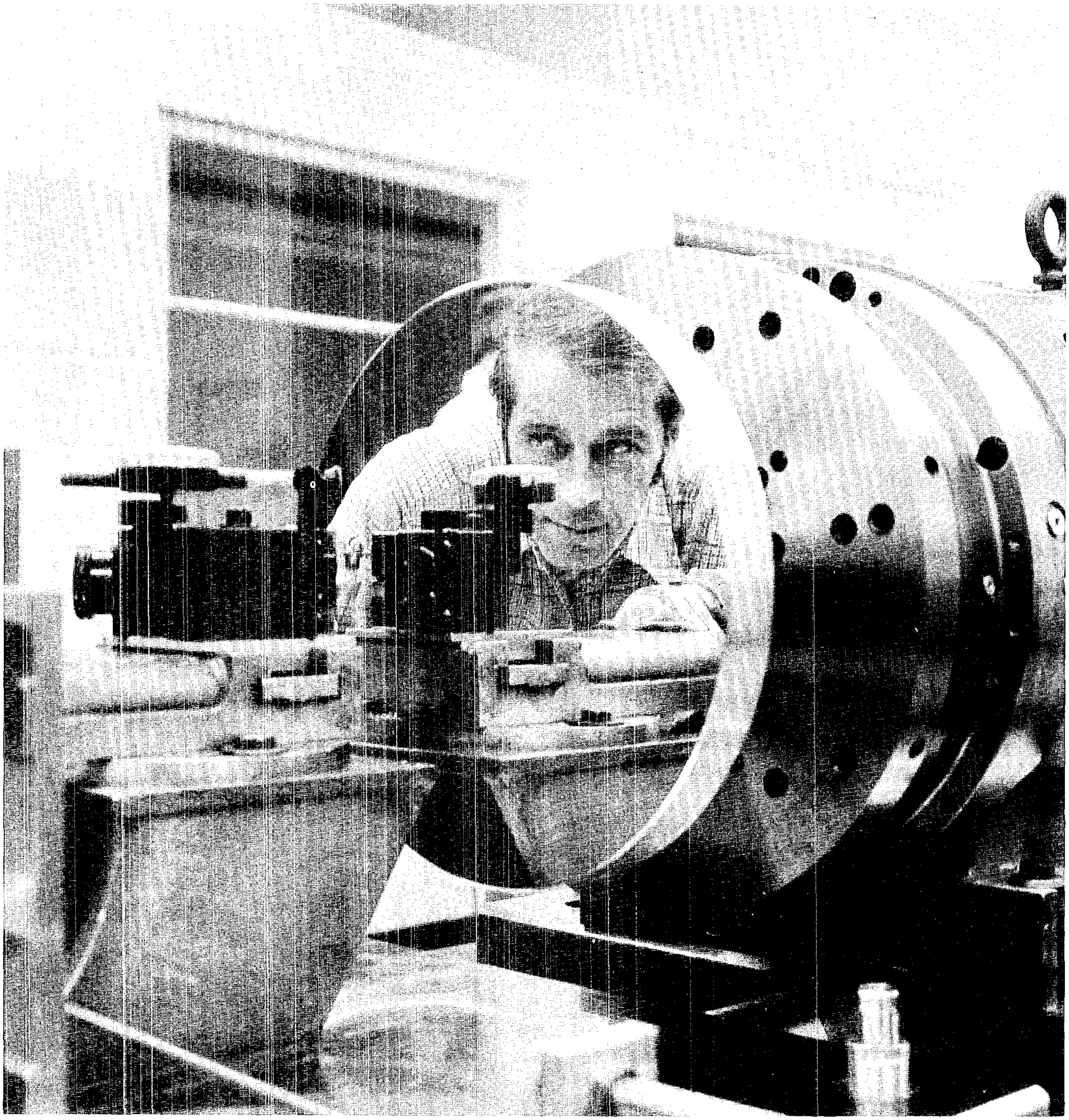
Unique among the Laboratory's departments and divisions, the Shop Department, except for classified weapons work, competes for "business." "We bid just like an outside vendor would on specific jobs. Like an outside vendor, we sometimes lose. Nevertheless, we're doing about $8 million a year," Stack says.

Stack is as proud of the apprenticeship program, which he started 12 years ago, as he is of his sophisticated new equipment. Since 1970, the LASL Machinist Apprenticeship Program has been conducted in cooperation with the New Mexico State Apprenticeship Council, which in turn is supported by the U.S. Department of Labor. "We have 27 apprentices in the program now, and 45 of our present machinists are graduates of the program. We are particularly pleased with the way young men from the surrounding area have responded. They're learning skills which are valuable to themselves and, of course, to the Laboratory," Stack says.

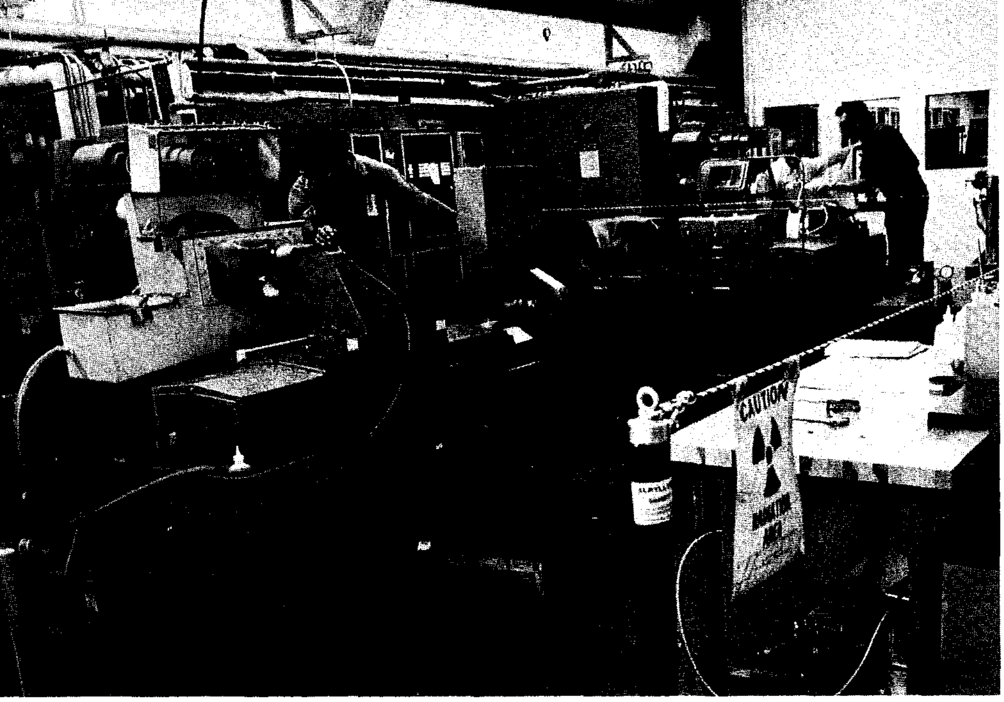
Apprentices enroll in a four-year training course including classroom work and scheduled instruction periods on nearly all shop machines. Upon successful completion of the program, directed by Albert Delgado, training supervisor, they are certified as journeyman machinists. With few exceptions, they continue as Shop Department employees. Concurrently, an active recruiting program is conducted to obtain qualified journeyman machinists from the "outside."

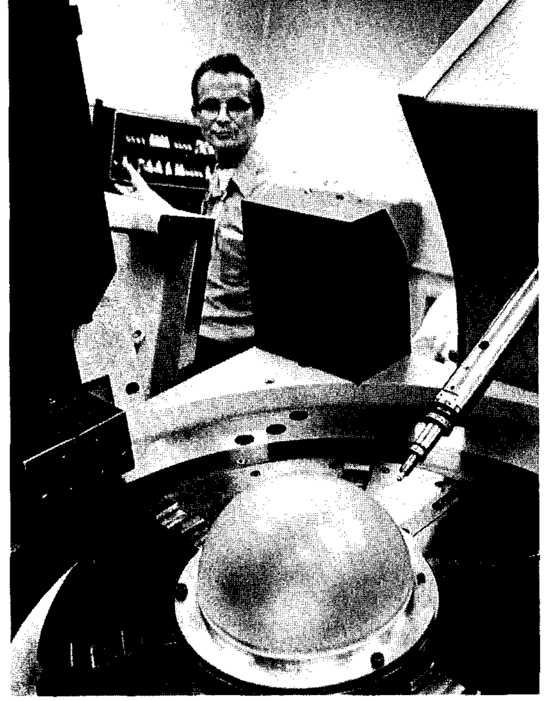
Machine shop work is no longer strictly the province of males. Grace Gutierrez is into the second year of her apprenticeship, and is currently assisting in operating various machines. Sharon Shilling, SD-1, formerly a clerk, is now writing computer programs in the APT language (a special language for controlling and monitoring numerical controlled shop machines).

The accompanying photos show much of what is new at the Shop Department, providing an overview of the Shop Department's broadening scope of activities and increasing sophistication.



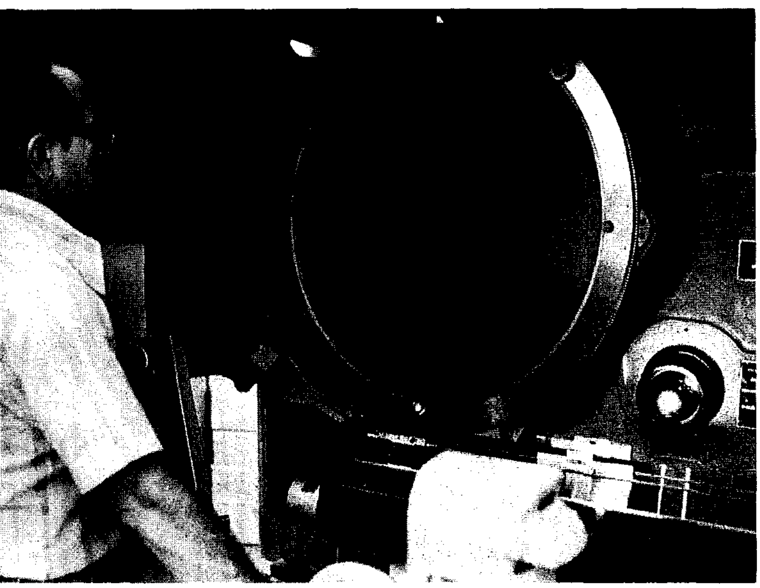
The Shop Department is developing its own version of a micro-finish machine that will be ready for limited usage early in 1975. It is designed to produce flat, concave, and convex parts up to 24 inches in diameter with surfaces machined to less than 1 micron. To achieve this mirrorlike finish, a diamond knife is used and elaborate means are employed to eliminate vibration, such as an air-bearing spindle, air slides and isolation mounts, and a non-contact coupling for the drive mechanism. Here, Dave Murphy, SD-1, checks the accuracy of the finish on aluminum with a laser interferometer—and incidentally demonstrates by his own reflection its quality.





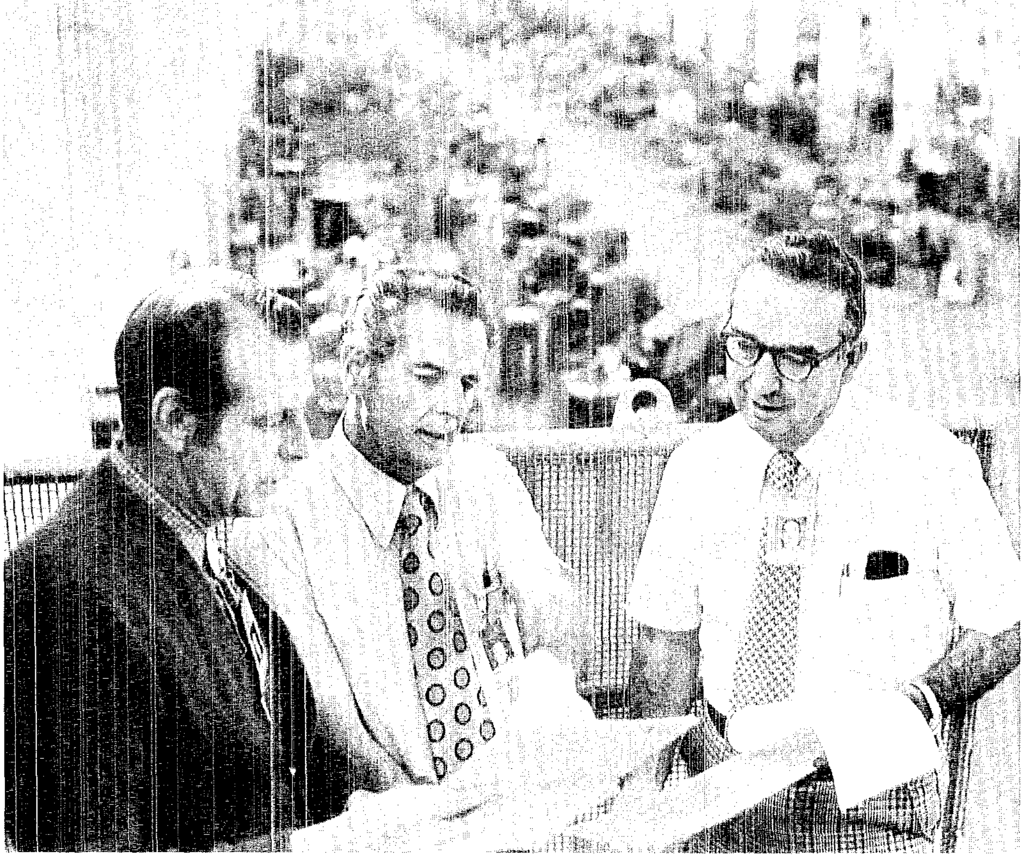
Two Excello turning and boring machines (lathes) are minicomputer controlled to finish complex free-form shapes to tolerances of 100 millionths of an inch. A minicomputer transmits the part dimensional data to the machines' hydraulic servosystems for precision positioning of the tool and work piece. A feedback circuit monitors the location of the machine slides. The lathes, which can be used for any material other than high explosive or plutonium, substantially increase LASL's fabricating capability, and cost about $200,000 each.

The finished product produced by the lathes is then checked by the Shop Department's new rotary contour gauge (right). Probes contacting both the exterior (shown in photo) and interior (not shown) surfaces plot spherical coordinates via a minicomputer behind Elbert Colston, SD-4 (inspection and quality assurance) group leader, in the background. Accuracy of the rotary contour gauge is to 5 millionths of an inch; sensitivity is such that even the thickness of a fingerprint can be measured. The gauge is installed, along with several other delicate measuring devices, in an environmentally controlled room which, among its other functions, provides a precisely controlled temperature to minimize measurement sensitive temperature corrections and also provide a nearly dust-free environment.



A handy device for checking threads on bolts and other finished surfaces is an optical comparator. Here, Bernie Gilbert, SD-4, shows how high-intensity light, lower right, silhouettes a ⅞″ bolt. The image is then enlarged and displayed at approximately 18″ diameter.

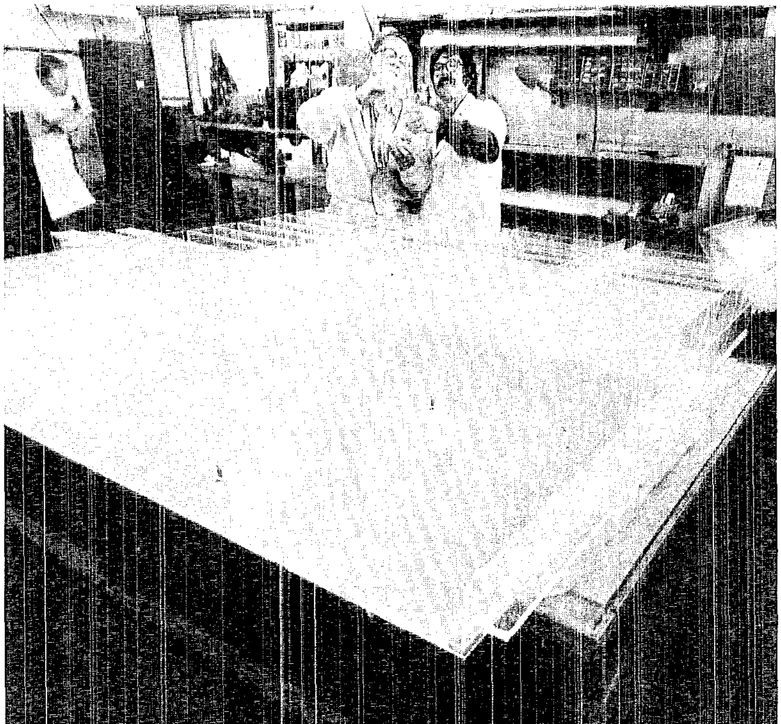
A new preferential three-point lap finishes spherical shapes to an accuracy of 5 millionths of an inch by rotating the spheres in precise orbits between 3 abrasive laps. This unit, here operated by Billie Hennigen, SD-1, is one of 6 installed in an environmentally controlled room.



Al Driesner, Frank Stack, and Al Zerwas, assistant department head, talk things over on a mezzanine overlooking the main shop area stretching 600 feet behind them. The three managers are as proud of the Shop Department's personnel as they are of its equipment. "These fellows can come up with just about anything you want them to do," says Driesner. "Somehow, they always come up with a neat looking job."

The Model Shop in LASL's Shop Department has more than paid for itself in problems it has spotted in various LASL construction projects. By building a scale model to construction plans and altering the model as changes are made, model makers such as John Mench and Bruce Martinez, above, have been able to call attention to discrepancies unnoticed in construction drawings for the new Plutonium Facility being built on Pajarito Road. Savings to date are estimated in excess of $50,000.

The Shop Department's new metrology laboratory has length and mass standards, traceable to the National Bureau of Standards, which are used to measure and calibrate gauges, tools, and weights. To assure the required accuracy, the facility is located in a room where temperature, humidity, and air purity are held to strict standards. Here Gene Roach, SD-4, uses a proficorder to check dimensions on a sphere. A diamond stylus traces the surface to a precision within 2 millionths of an inch.



NUCLEAR HEAT FOR INDUSTRY
a coming revolution?

Process heat—that heat used by a plant for an industrial process—is a term almost totally unknown by the public and one with which even many scientists are unfamiliar. But it is a term destined to become well known to all as the energy crisis inexorably tightens its grip on the American way of life over the coming decades.

That is because today process heat accounts for some 30% of America's energy consumption (more than consumed by the nation's automobiles) and is projected to account for an even larger percentage.

Since the birth of the atomic age, it has been obvious that nuclear reactors could provide heat in the massive amounts required by industries that make steel and paper, that make plastics and a host of other products. But during an age, now fast receding, of cheap and abundant natural fuels, and in the face of formidable economic and technological obstacles, the development of nuclear process heat languished.

The sleeping giant may be awakening, though. A milestone meeting at the Los Alamos Scientific Laboratory October 1-3 was attended by more than 250 scientists, nuclear engineers, and industrial executives from the United States and 5 foreign countries.

Originated and cosponsored by the San Diego and Trinity (New Mexico) sections of the American Nuclear Society, it was, as its name suggests, the First National Topical Meeting on Nuclear Process Heat Applications. Bob Duffield, Q-Division leader, served as chairman.

"I was impressed by the variety of backgrounds represented at this meeting," Duffield says. "More than 30% of the participants were other than nuclear scientists and engineers and included executives and consultants connected with the petroleum, chemical, steel, and coal industries."

Impressive, too, was the stature of the participants. Alvin Weinberg, director of the Federal Energy Administration's Office of Energy Research and Development, and former New Mexico Governor Jack Campbell, president of the Federation of Rocky Mountain States, were banquet speakers. John Landis, of General Atomic Company, was honorary chairman of the meeting. Carl Walske, president of the Atomic Industrial Forum, Irving Spiewak, director of the Oak Ridge National Laboratory, and John Andelin, scientific advisor to U.S. Representative Mike McCormack, were among participants of note.

The meeting was a massive exercise in organization and logistics. Managing a myriad of details from collecting papers to arranging Albuquerque airport pickups and translation services for attendees from overseas were Dick Malenfant, Q-DO, Bob Porton, ISD-2 group leader, Doug O'Dell, TD-5, Darryl Smith, A-1, and David R. Smith, P-5.

The three-day program, consisting of the presentation of papers and panel discussions in the Administration Building auditorium, programs for wives, banquets at the Los Alamos Community Center, and a visit to LASL's Fenton Hill geothermal site on Thursday, went as much like clockwork as can be expected of such affairs.

LASL personnel with roles in the meeting were Doug Balcomb, Q-Division assistant leader for analysis and planning, who presented a paper on high temperature reactors; Morton C. Smith, Q-22 group leader who described LASL's geothermal program; Mel Bowman, CMB-Division alternate leader who talked on nuclear process heat for thermochemical decomposition of water to produce hydrogen; and LASL's Deputy Director Raemer Schreiber, who served as chairman for an afternoon session.

Commentary

Nuclear process heat is a sleeping giant that is going to take a long time to awaken. As Edwin Cox of Black and Veatch remarked while delivering a paper, on operational aspects of integrated plants using nuclear energy, "If you're planning to go nuclear in 1985, you're already too late."

A common thread running through the meeting was the formidable technological problems yet to be solved, compounded by the intricacies of satisfying federal, state, and local regulations.

Nuclear reactors for generating process heat were generally studied in terms of megawatts and "megabucks"—very large installations whose capital costs were described in hundreds of millions of dollars. Simply planning and arranging financing of such mammoth plants, not to mention their construction, requires years stretching into decades.

On the other hand, there was no questioning that nuclear process heat, in whatever form, *must* come. Domestic crude oil and natural gas production will peak in 1980, level off, then decline. Coal production will follow a similar curve, but with a peak occurring after the turn of the century. All expect costs to escalate and, in so doing, make nuclear process heat increasingly attractive to all industries, including such industries as coal gasification and petrochemicals. These would begin using nuclear heat for processing rath-

A few key participants: Alvin Weinberg, director of the Federal Energy Administration's Office of Energy Research and Development, A. T. McMain, General Atomic Company, and Tom Barnhart, U. S. Steel, discuss nuclear process heat at a press conference.

er than burning a portion of the increasingly precious fuel itself to obtain process heat. Fossil fuels will be considered more as a source of "building blocks" for other materials rather than as a material "wasted" as energy.

The supply of uranium is basic. Demand for uranium is expected to increase ten-fold from 12,000 tons annually at present to 128,000 tons in the year 2000, according to Larry Werts, Kerr-McGee Corporation. Yet, due to economic factors, little uranium ore exploration has taken place in recent years. Werts believed that ores ample to supply national needs well into the next century exist within the United States, especially in the Rocky Mountain region. Werts added that the industry may have to settle for ores of lower grade.

Unlike other fuels, continuing and even radical increases in uranium costs will have little impact on the economics of nuclear process heat. The volume of fuel consumed in nuclear reactors is but a very small fraction of the volume of fossil fuels burned in present industrial processes. Thus, it is the cost of conventional fuels, rather than that of nuclear, that becomes the prime determinant of at what point in time it becomes advantageous to employ nuclear reactors for process heat.

Thinking Big

Many papers were presented on the feasibility of big reactors, especially the High Temperature Gas-Cooled Reactor, and with such reactors incorporated into nuclear utility-industrial complexes or parks. An HTGR, providing steam at temperatures of 1600°F or even higher, would provide far more heat than any but a few of the largest industrial plants could use. But a cluster of industries could utilize most or all of the reactor's heat. A reactor used to generate electricity with process heat as a by-product would obviously represent a more efficient utilization of energy than one used for generating electricity or power alone. The utility would operate the reactor, relieving industry of this responsibility, and various joint financing schemes would make such an installation economically feasible.

Because the reliability of reactors is not at present satisfactorily high, the utility would have 2 or more reactors to provide continuous process heat when one of the reactors is "down." And development of these parks at some distance from urban centers would satisfy an important segment of public opinion in respect to safety and environmental protection.

Because the meeting was concerned primarily with scientific and technological topics, the economic and societal impact of these proposed parks were treated but lightly. Unanswered were such questions as whether or not American industry, even the largest, could bear the traumatic costs and massive dislocations of migrating in numbers to these parks. Some wondered if bedroom communities, followed by small cities, would not soon develop around the parks, obviating the very isolation that such parks were originally supposed to achieve.

One futuristic scheme envisioned parks built not on land, but on barges towed to offshore moorings. Some wondered how the delivery of supplies, let alone the commutation of workers, could be accomplished economically.

Thinking Small

While thinking big was the dominant theme at the meeting, a small but articulate minority presented papers expounding the virtues of the small reactor. Conceding significant advantages to the large reactor because of economies of scale, proponents of small reactors nevertheless urged research on small reactors as well as large.

During a press conference on the opening day of the meeting, LASL Director Harold Agnew reminded that LASL had developed a body of knowledge on the design of small reactors for the Rover and NERVA programs of the past.

Apparent to all was the desirability of making available to American industry small reactors to serve varying temperature and heat requirements. The economies of "plugging in" a small reactor to replace a conventional process heat source in an existing plant, such as a paper mill in a remote area, might more than compensate for economies of scale such a plant might enjoy at a nuclear utility-industrial park.

As of now, the prospect for intensive development of small reactors is not encouraging. The nuclear reactor industry is geared to the design and building of very large reactors for the electric utility industry. And the technological obstacles are considerably more complex than the term "plugging in" implies.

Acting Big

Lest the foregoing cast a pall on the whole topic, the dramatic moments of the meeting were papers presented showing determined and positive efforts being made today, with actual projects in progress.

Overseas, "zero hour" is here for certain industrialized nations whose fossil fuel resources are approaching or are at depletion.

In Japan, the Japanese Atomic Energy Research Institute and the Association of Nuclear Steelmaking (20% of Japan's energy is consumed in steelmaking) are actively researching and designing large, very high temperature reactors. An experimental reactor is expected to be in operation in the early 1980's with industrial reactors following, hopefully, in a matter of a few years.

In England, the Dragon Project of the Atomic Energy establishment, which comprises 12 signatory countries participating in reactor development for electrical generation, is now promoting similar cooperation in development of process nuclear heat.

And in Germany, a coal gasification project is under way between the Rhine River and the Belgian border with plans to distribute the gas produced to nearby chemical and steelmaking plants as well as to domestic users via existing natural gas pipelines. A group of 8 major German nuclear reactor, coal mining, steel, and heavy equipment companies are working towards development of a process heat reactor by 1983.

In the U.S.A., the Consumers Power Company of Midland, Mich., and Dow Chemical Corporation have entered into a joint venture which provides for building a power generating/heat process reactor, with the utility selling Dow process steam as a by-product of power generation. Papers presented by Robert Quade of General Atomic Company and J. Burroughs of Dow described the many legal difficulties encountered. A utility is generally prohibited from engaging in other than the utility business. Yet, difficulties are being surmounted and the installation is being built.

Perhaps the most dramatic presentation was made by Tom Barnhart of U.S. Steel Corporation, speaking on behalf of a task force of the American Iron and Steel Institute working in conjunction with the General Atomic Company of San Diego, California. He reported extensive studies on the feasibility of nuclear process heat for steel making, concluding that the council was recommending "go." The audience was impressed both by the scope of the program and the determined optimism of its participants.

A Nuclear-Hydrogen World?

Coal gasification and liquefaction was the subject of several papers, whose authors visualized the day when coal would be processed to make methane and other gasses, or to form useful organic substances, rather than "waste" coal as a fuel.

Most of these schemes included the production of hydrogen and oxygen from water as part of the process. With nuclear process heat, hydrogen could be produced in abundance, leading to speculations that nuclear energy and hydrogen might form the basis of our economy, with corresponding environmental advantages, in some future age.

Looking Ahead

The 2 major obstacles to more rapid development of nuclear process heat are technological and economic. Chief among the technological obstacles is the interface—the heat exchanging mechanism—between the reactor and the industrial user, assuring, above all, complete radiological protection.

Yet, the designs are on the board and the technology can be surmised. It remains to be done and proven.

The reliability of reactors from an operational point of view (as much as 20% downtime is experienced in some large reactors) remains a nagging consideration.

Yet, continued development of reactors will surely mitigate this problem.

The astronomical cost of reactors and operational and safeguard systems are a major stumbling block.

Yet, as the costs of conventional fuels escalate, there will occur a point in time when, all factors considered, nuclear reactors will provide cheaper process heat.

Finally, the simple fact that supplies of fossil fuels will dwindle and eventually vanish will cause many industries, sooner or later, to chuck their charts, graphs, and studies into the ashcan and get on with it. It will be a matter of survival.

All this is why the First National Topical Meeting on Nuclear Process Heat Application was in truth a milestone. Nuclear process heat is still largely in the "talk" stage. This meeting, by focusing attention and generating a copious exchange of information and a measure of optimism on the subject, may have provided the first significant impetus leading to eventual application.

More Time with Marge

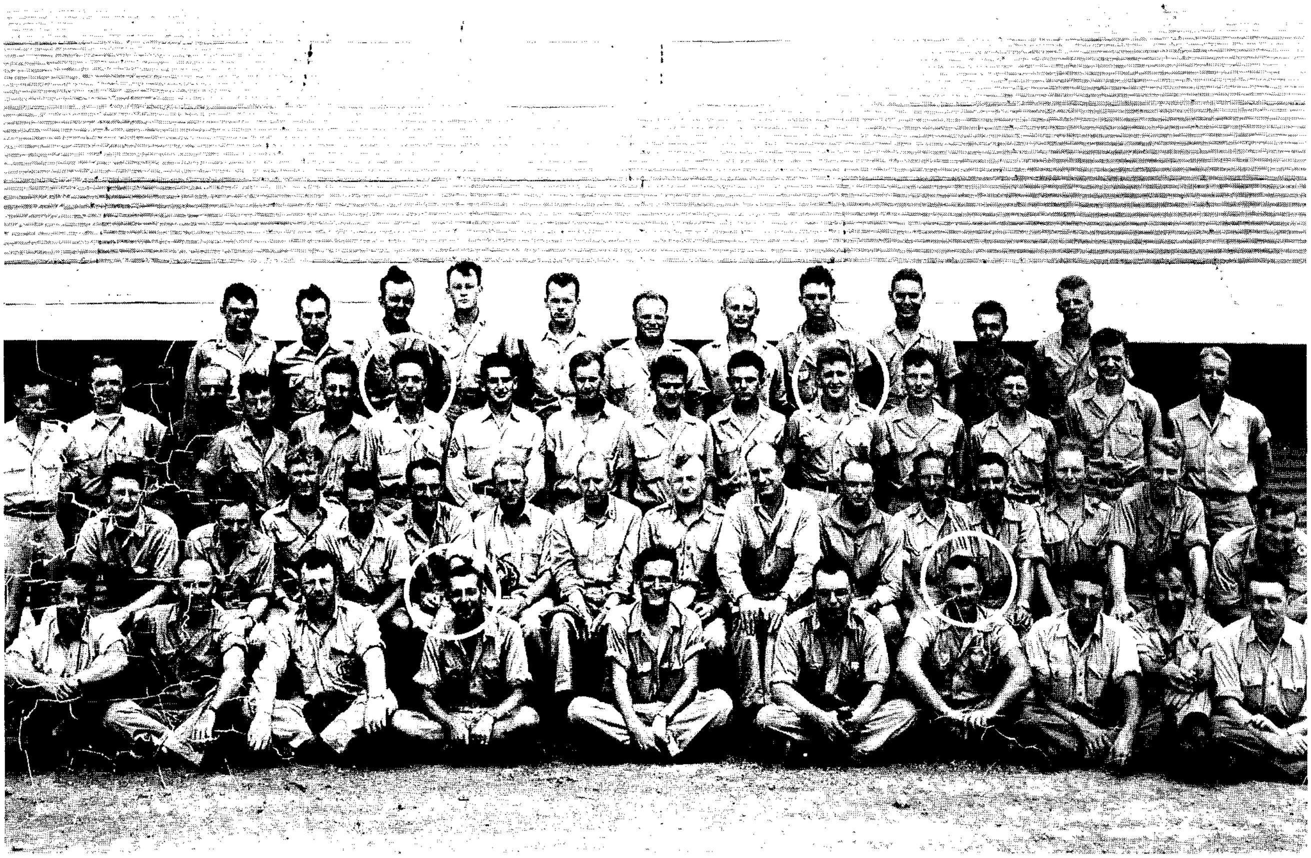
At home: Marge, Schreib, and Kachina

"What am I going to do in my retirement? Well, first I want to really get retired and have some time to think about what I want to do when I am not driven by a schedule and a lot of responsibilities. For a while, at any rate, I have plenty to do just to catch up with myself--chores around the house, fool around with rocks and jewelry, and sort out the junk I have collected through the years. Later, Marge and I will probably do some travelling, but will keep Los Alamos as our home base since we can't think of a better place to live and we have so many friends here."

Those were some of the relaxed musings of Raemer "Schreib" Schreiber, deputy director of the Los Alamos Scientific Laboratory, on the eve of his retirement, December 2.

"I'll probably continue to visit the Laboratory--hope to, anyway," he continued. "No, I won't go out looking for another job."

Schreib very well could go out and get another job. At 64, he is as fit, quick, and competent as men



At Tinian Island where World War II atomic weapons were assembled in August, 1945. Men still associated with LASL are circled: Second row from top: Schreiber and Harold Agnew, Director. Bottom row: Harlow Russ, WX-1, and John Tucker, WX-7. The photo was cracked when Schreiber attempted to stuff *it in his baggage for the trip home.*

many years his junior.

"I'll miss my many contacts at the Lab—and I'm going to have some withdrawal symptoms in realizing that I will no longer carry the clout that I once had," Schreib continued. "But I plan to keep in touch with the program and perhaps learn something new. My main reason for retiring now is to have some time for Marge and me to do things on a relaxed time scale—go when we want to go and return when we feel like it. No more scheduling of vacations."

"Marge," more formally "Marguerite," is, of course, Mrs. Schrieber. She has been a part of Schrieb's life since the depression years when bright graduate students often earned less than WPA workers, and has been a part of life on The Hill since the mud-street and army-barracks days of World War II's Manhattan Engineer District.

During those early years, she was a member of the sometimes militant Town Council that presented the views of the civilian population to the Commanding Officer. Later she was involved in various community affairs, including a term as a member of the Los Alamos Board of Education.

Schreib and Marge, with their daughter Paula, now Mrs. B. Roy Saunders, White Rock, came to Los Alamos in November, 1943, from Purdue where he had been working as a research associate on a project with the university's cyclotron to measure deuterium-tritium cross sections. Before he arrived, he was not at all certain of anything except that more than a few of the nation's leading physicists were also heading for Los Alamos, and that the project was very important and very secret.

"I would not say that the trip to Los Alamos was a very pleasant experience," Schreib recalls. "We went by the old road that goes through El Rancho and San Ildefonso. Coming up the hill, we had to use some of the old switchbacks. The last stretch below the old guard gate was the worst. You can still see the remnants of that road—it cuts off up the cliff just below the Clinton P. Anderson plaque on

East Road. We followed a loaded water truck that was grinding along at about a quarter of a mile per hour and I wasn't quite sure if the clutch and brakes would hold out."

Schreib found himself in company with such illustrious scientists as Enrico Fermi, Don Kerst, Marshall Holloway, Charles P. Baker, and L. D. P. King working on the Water Boiler—the world's first homogeneous reactor (*The Atom*, Sept.-Oct. 1974).

In 1945, Schreib transferred to G-Division ("G" stood for "gadget," a nickname for the implosion, or Fat Man, bomb) to help develop the nuclear assembly procedures and assemble the field kits for both the Trinity Test and the overseas operation. He was there at Trinity as a member of the nuclear assembly team at MacDonald's Ranch, about 1½ miles from ground zero, and he observed the world's first atomic detonation from Base Camp.

"It scared the hell out of me," he remembers.

Shortly after Trinity, Schreib flew to Tinian in the Marianna Islands to join an advance party, headed by Charles Baker, whose mission it was to ready the bombs that would end the war. While others assembled the "gun" type bomb that was to be dropped on Hiroshima, Schreib and others began work on the Fat Man.

On the third morning after the Hiroshima strike, no word had been received from the Japanese signalling the hoped-for surrender. The Fat Man strike was ordered. The bomb had to take off armed, so a radiation team was formed in case of a takeoff crash. According to Schreib, "We did not know exactly what to do, but we had some geiger counters and an MP arm band apiece, and an officer with a detachment of men to chase people out of the danger area."

Following the Nagasaki strike, Schreib participated in the Operation Crossroads tests at Bikini Atoll in 1946 and was deeply involved in the nuclear research and weapons design of the times. In 1949, he became associate W-Division leader, and, in 1950, with the big push toward the development of a thermonuclear weapon in full swing, he became successively acting W-Division leader and W-Division leader.

In 1955, Schreiber was asked to head a program that eventually evolved into Project Rover for the development of a nuclear rocket motor for the ICBM, with the mission transferred to the National Aeronautics and Space Administration space program in 1958. By 1959, the design of a graphite-based reactor using hydrogen propellant had been established and Kiwi-A, the first of a long series of nuclear rocket test reactors, was ready for its trials at Jackass Flats adjacent to the Nevada Test Site. Schreib was there.

The retirement of Darol Froman in 1962 opened the position of technical associate director, to which Schreib was appointed. In 1972, his title was changed to that of deputy director.

Schreib's leadership in nuclear science has been evidenced outside of the Laboratory as well as within. He has held several high offices of the American Nuclear Society, serving as its president in 1967-68. He is a Fellow of the American Physical Society, American Institute of Aeronautics and Astronautics, and the American Association for the Advancement of Science. In 1964 he was granted an honorary Doctor of Science degree from his alma mater, Purdue University.

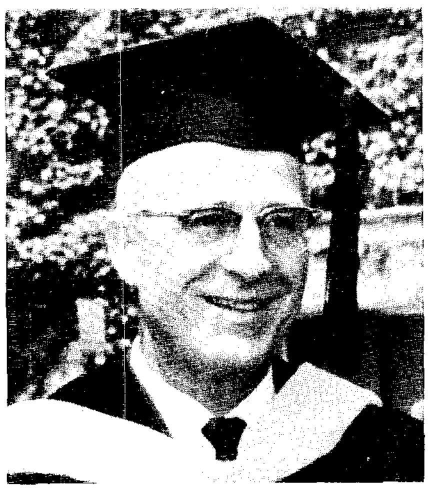
The usual retirement laudatory concludes with fulsome and flowery testimony to the subject's seemingly endless virtues: his warm personality, his wisdom, and how much his example and guidance has meant to us lesser mortals. But Schreib wouldn't stand for that sort of gush.

Suffice to say that few men in the Laboratory's history have had so many friends within and without the Laboratory. He will be missed.

"Don't call it goodbye," Schreib cautions. "After all, I'll still be around."

Good.

At Kwajalein Atoll aboard the USS Albemarle, June 1946.



At Purdue University to receive an honorary doctorate, May 1964.

At LASL just prior to retirement, November 1974.

short subjects

Honors: **George Shepherd,** H-9, received an Atomic Energy Commission Special Achievement Award for planning and budgetary work conducted while on a two-year assignment in Washington, D.C., as a member of the AEC's Division of Biomedical and Environmental Research. **Morton C. Smith,** Q-22 group leader, has been named recipient of the New Mexico Academy of Science's Distinguished Scientist of the Year Award for 1974 for geothermal research. **Esther Bottom,** H-2, is the first registered nurse in New Mexico to have been certified by examination by the American Board for Occupational Health Nurses, Inc., and has been listed in the Board's directory. **The Laboratory** received a National Aeronautics and Space Administration Group Achievement Award for contributing to the successful development and delivery of the 4 radioisotope generators aboard the Pioneer 10 space mission.

From the AEC: **James McNally,** ADWP-O, has been appointed assistant director for laser and isotope technology in the AEC's Division of Military Application in Germantown, Maryland.

Some 200 persons representing many of the 300 member organizations of the LAMPF Users Group attended the annual meeting held November 11-12 in Los Alamos. The LAMPF accelerator will be shut down December 24 to allow a number of operations to be conducted leading to higher intensity operation when the accelerator is reactivated in July, 1975.

E-Division (electronics and instrumentation) has placed into operation a terminal linking LASL to computer centers at MIT, Lawrence-Livermore and Lawrence-Berkeley Laboratories, UCLA, the University of London, Rand Corporation and a number of other institutions. Argonne Laboratory and New York University-Courant Institute will be on-line in the near future. E-Division will also provide ARPANET terminals for individual or group usage at other points throughout LASL.

The Los Alamos Scientific Laboratory hosted an energy resource and evaluation conference November 13-14, the purpose of which was to provide an overview of energy-related activities at LASL and to discuss ways for the Laboratory to interact with the states of the Rocky Mountain region. Some 40 representatives of state, regional and federal agencies from 8 states as well as from other laboratories and the U.S. Atomic Energy Commission attended.

Bob Keepin, group leader A-1 (nuclear analysis research) stating that "the spate of recent publicity and present criticism of U.S. nuclear safeguards posture has gone largely unchallenged by safeguards and materials management professionals," has presented rebuttals recently in the form of articles, book reviews, and interviews in journals such as **Nuclear News, Laser Focus,** and **Nucleonics Week.** Keepin cites LASL's DYMAC (Dynamic Materials Control) program being developed for the AEC as providing a stringent, multiple-layered defense against diversion, theft, or accidental loss of nuclear materials.

Charles Browne, former J-Division leader, has been named assistant director for administration (ADA). His responsibilities will include supervision of the departments, indirect operations, and communications with the Atomic Energy Comission's Los Alamos Area Office and the University of California on administrative matters.

Browne was assigned to LASL as a military staff member in 1952 and joined LASL as alternate group leader of J-11 in 1955. He is a Fellow of the American Physical Society and of the American Institute of Chemists, and a member of Sigma Xi.

John Hopkins, former assistant division leader, has been named J-Division leader, replacing Browne. Other appointments from within J-Division are **Robert Brownlee** and **Robert Campbell** as associate division leaders and **Robert Bradshaw** as test group director.

Ev Miller, ENG-4, shows a steam trap to one of 46 LASL and Zia personnel participating in two-hour steam-trap sessions held at the Zia Administration Building in Los Alamos.

Show and Tell

Two recent training sessions conducted by the Los Alamos Scientific Laboratory illustrate how expertise developed by LASL is shared:

On October 7-11, Group A-1 (nuclear analysis research) conducted a training course directed by Ron Augustson and Doug Reilly on nondestructive assay, or the use of radiation detectors to determine the quantity of radioactive material. Classroom sessions were held at A-1's laboratories at Ten Site, and field trips were made to the Shop Department. There instructors and participants calibrated gamma ray detectors outdoors, then moved indoors to train the instruments on possible fissionable material in air ducts. Represented by 23 participants were laboratories and companies such as Union Carbide Corporation, the Hanford Engineering Development Laboratory, the Goodyear Atomic Corporation, the National Lead Company of Ohio, Battelle Northwest Laboratories, the International Atomic Energy Agency of Vienna, Austria, and a number of AEC contractors and operations offices. This was the second of such annual training sessions.

From October 15 through November 12, LASL, in cooperation with the Zia Company, conducted an Industrial Steam Trap School at the Zia Administration Building in Los Alamos. Ev Miller, ENG-4 (maintenance), conducted 8 two-hour sessions on trouble-shooting and servicing steam traps, important in energy conservation. The session concluded with 46 personnel of the Zia Company and LASL's Engineering Department being graduated. Refresher courses will be held every year.

Other training programs include those for respirators by Group H-5 (industrial hygiene), vacuum technology sponsored by Group MP-9 (accelerator systems development), plus a number of in-house programs such as for supervisory training, computer and data processing technology, and safety.

If LASL were an educational institution, its curriculum and alumni would be impressive indeed.

Claude Beverly and John Watkins, Union Carbide Nuclear Division, watch as Jack Parker, A-1 and Cecil Kindle, Atlantic Richfield Hanford Company, train a gamma-ray detector on a Shop Department air duct searching for traces of radioactive material. Field trips like this complement classroom sessions on nondestructive assay.

Clearing the Air

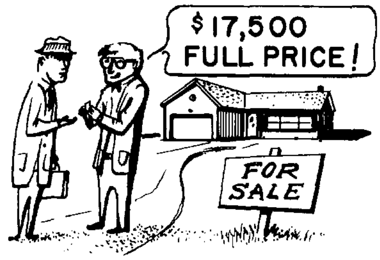
Nonsmokers generally reacted with satisfaction and smokers had no comment (publicly) on the "no smoking" stickers that proliferated in October around the Los Alamos Scientific Laboratory. The stickers appeared in passenger elevators, most conference rooms, and in work and other areas where under some conditions air circulation can become inadequate.

The "no smoking" stickers followed the issuance of smoking regulations by the Director's Office on October 11, which also included rules for auditoriums, cafeterias, and passenger-carrying taxis and shuttle airplanes.

Interestingly, LASL's "no smoking" program was implemented as an organization called Action on Smoking and Health (ASH) of Washington, D.C., levelled sharp criticism at the Occupational Safety and Health Administration (OSHA) for proposing standards that "fail to control the contamination of the workplace environment by carbon monoxide generated by the smoking of tobacco products." ASH recommends that OSHA's proposed standards include provisions covering smoking in small, enclosed areas, medical facilities, and meeting rooms, and that smoking and nonsmoking areas be established in other offices.

If OSHA does implement such standards, they'll have virtually no effect on LASL. LASL will have already complied.

10 years ago in los alamos



Culled from the November and December, 1964, files of The Atom and the Los Alamos Monitor by Robert Y. Porton

Awanyu's Gifts Found

Four Los Alamos high school boys have discovered a dozen prehistoric pottery jars and bowls under the White Rock Canyon rim. It is believed the pottery may have been put there by Tewa Indians from Tsirege Pueblo as offerings to the rain god Awanyu centuries ago. Awanyu's eight-foot petroglyph adorns a cliff face overlooking Pajarito Road near Highway 4.

(ed. note:—Several of the pots are on display in the Bradbury Science Hall).

100th Person To Get Degree

William Daniels, a chemist, has become the 100th person to complete degree-requirement work in the academic training program that is conducted by the Laboratory in cooperation with the University of New Mexico. Daniels will be awarded his Ph.D. in chemistry at UNM commencement exercises next June.

Memorial

A memorial to the late President John F. Kennedy, the only President ever to visit Los Alamos, was dedicated December 6. A functional memorial, it serves as the entrance to the local football field where Kennedy addressed Los Alamos citizens during his December 7, 1962 visit. The monument was paid for entirely by contributions of people in this area.

For Sale

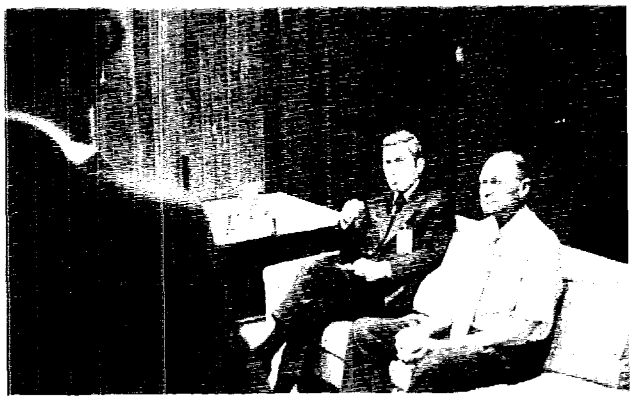
(Advertisement) Nice three-bedroom home in White Rock. One and ¾ bath, large kitchen, dinette and living room. Plenty of closets, stove with hood, disposal, drapes and traverse rods. Two-car carport with storage, rear yard fully fenced, $17,500 full price!

Bomb Used in Physics Experiment

LASL scientists have used an underground test of an atomic bomb at the Nevada Test Site as part of a highly sophisticated physics experiment. Involving hundreds of employees, the pioneering achievement marked the first time that a weapons-oriented device had been used in a "pure science" experiment. The low yield underground explosion was used as a neutron source to produce data that scientists say would have taken decades to acquire through the use of conventional particle accelerators.

Among Our Guests . . .

Betsy Ancker-Johnson, assistant secretary for science and technology for the U.S. Department of Commerce, came to Los Alamos on November 5 to speak on "The Antitrust Theory of Physics, Chemistry, and Other Useful Arts" at a colloquium. She also talked with Laboratory Director Harold Agnew, right, about LASL activities.



F. C. Ikle, director of the U.S. Arms and Disarmament Agency, and Duncan MacDougall, associate director for weapons, listen as Carl Henry, group A-2 alternate leader, explains aspects of nuclear detection and identification on October 30. Ikle is advisor to the President and the Secretary of State.

On November 7-8, U.S. Senator Paul Fannin visited LASL for briefings on energy and other programs. Left to right, Fannin, his energy aide, Margaret Lane, and, back to camera, Laboratory Director Harold Agnew.

Following an American Physical Society seminar on plasma physics held in Albuquerque, over 100 participants visited LASL to view thermonuclear energy experiments in progress. Here John McLeod, L-2, left, describes L-Division's four-beam neodymium glass laser. The seminar attracted over 1,200 participants from the U.S.A. and abroad.

Edythe Moore, right, president of the Special Libraries Association, visited the LASL Library November 15. Here with Art Freed, right center, ISD-4 group leader, she looks over plans for the National Security and Resources Study Center which will eventually house the LASL Library. Watching left to right are Lois Godfrey, ISD-4, and Sandra Coleman, president of the Association's Rio Grande chaper.

What, you wear safety glasses? Take it from Charles Jaworski, CMB-6 (materials technology), it's a good idea. While Jaworski was operating a press, material shattered. Fragments smashed his safety glasses—but his sight was spared.

Also concerned with facial matters, but in a lighter vein, are Liz Chavez, ENG-10, Donna Gonzales, ENG-2, and Sally Duran, ENG-8. Donna missed qualifying by a mere half-inch as a volunteer subject for testing the fit of rubber facepieces of respirators by Group H-5 (industrial hygiene). The respirator section had advertised in "The Bulletin" for volunteers with small faces: women whose faces measure less than 4 inches from the top of the nose bridge to the lower tip of the chin, and men whose faces measure less than 5 inches. If you "measure up" phone Louis Geoffrion or Jose Bustos at 667-7280. LASL employees cannot serve as subjects during normal working hours, but other hours may be arranged. Each test is expected to require 1 to 2 hours time, for which the volunteer is paid, and no knowledge of respirators is required.